

CLAIMS

1. A fluid treatment element comprising:
 - a fluid treatment pack which includes a fluid treatment medium, an axis, first and second opposite ends, and a plurality of pleats extending axially between the first and second ends, wherein each pleat has a folded end, an open end and first and second legs extending between the folded end and the open end of the pleat;
 - a spacer arrangement associated with the pleats of the fluid treatment pack to define a first region within each pleat that is occupied by the spacer arrangement and a second region within each pleat that is substantially free of structure;
 - a first fluid flow path which extends axially along the fluid treatment pack within the pleats, the first fluid flow path including the second region of each pleat; and
 - a second fluid flow path which extends through the pleated fluid treatment medium from or to the first fluid flow path.
2. The fluid treatment element of claim 1 wherein the spacer arrangement is positioned between the first and second legs of each pleat and the second region extends axially along the pleat between the first and second legs.
3. The fluid treatment element of claim 1 wherein the pleated fluid treatment pack comprises a composite including the fluid treatment medium and a porous medium and wherein the spacer arrangement is positioned between the fluid treatment medium and the porous medium and the second region extends axially along the pleat between the fluid treatment medium and the porous medium.
4. The fluid treatment element of claim 3 wherein the porous medium comprises a drainage medium.
5. The fluid treatment element of any of claims 1-4 wherein the region substantially free of structure adjoins the fluid treatment medium.
6. The fluid treatment element of any of claims 1-5 further comprising a sealing mechanism disposed at each end of the fluid treatment pack.

7. The fluid treatment element of any of claims 1-6 further comprising a surround fitted around the exterior of the fluid treatment pack and having openings only near one end of the fluid treatment pack.

8. A fluid treatment element comprising:

a hollow, generally cylindrical fluid treatment pack which includes an axis, an interior, first and second opposite ends, and a pleated composite, wherein the pleated composite defines a plurality of pleats extending axially between the first and second ends, each pleat having a folded outer end, an open inner end, and first and second legs extending between the folded outer end and the open inner end, and wherein the pleated composite includes a fluid treatment medium having an inner surface and an outer surface and a drainage medium positioned along the outer surface of the fluid treatment medium;

a spacer arrangement associated with the pleats of the fluid treatment pack inwardly from the inner surface of the fluid treatment medium, wherein the spacer arrangement includes a first spacer positioned proximate the first end of the fluid treatment pack, a second spacer positioned proximate the second end of the fluid treatment pack and a region which extends axially along each pleat between the first and second spacers and which is substantially free of structure;

a core arrangement positioned in the hollow interior of the fluid treatment pack and including a blind portion axially spaced from the first end and the second end of the fluid treatment pack, wherein the blind portion resists fluid flow radially inwardly from the axially extending regions of the fluid treatment pack; and

first and second end caps respectively sealed to the first and second ends of the fluid treatment pack, each end cap having a central opening which fluidly communicates with the axially extending regions of the pleats.

9. The fluid treatment element of claim 8 wherein the first and second spacers are positioned between the first and second legs of each pleat and the region substantially free of structure extends between the first and second legs.

10. The fluid treatment element of claim 8 wherein the composite further includes a porous medium positioned along the inner surface of the fluid treatment medium and wherein

the first and second spacers are positioned between the fluid treatment medium and the porous medium and the region substantially free of structure extends between the fluid treatment medium and the porous medium.

11. The fluid treatment element of claim 10 wherein the porous medium comprises a drainage medium.

12. The fluid treatment element of any of claims 8-11 wherein the region substantially free of structure adjoins the fluid treatment medium.

13. A fluid treatment element comprising:

a generally cylindrical fluid treatment pack which includes an axis, and interior and exterior, first and second opposite ends and a pleated composite, wherein the pleated composite defines a plurality of pleats extending axially between the first and second ends, each pleat having a folded inner end, an open outer end, and first and second legs extending between the folded inner end and the open outer end, and wherein the pleated composite includes a fluid treatment medium having an inner surface and an outer surface and a drainage medium positioned along the inner surface of the fluid treatment medium;

a spacer arrangement associated with the pleats of the fluid treatment pack outwardly from the outer surface of the fluid treatment medium, wherein the spacer arrangement includes a first spacer positioned proximate the first end of the fluid treatment pack, a second spacer positioned proximate the second end of the fluid treatment pack, and a region which extends axially along each pleat between the first and second spacers and which is substantially free of structure;

an outer surround positioned around the exterior of the fluid treatment pack and including a blind portion axially spaced from the first end and the second end of the fluid treatment pack, wherein the blind portion resists fluid flow radially outwardly from the axially extending regions of the fluid treatment pack; and

first and second end caps respectively sealed to the first and second ends of the fluid treatment pack, each end cap having a central opening which fluidly communicates with the interior of the fluid treatment pack.

14. The fluid treatment element of claim 13 wherein the first and second spacers are positioned between the first and second legs of each pleat and the region substantially free of structure extends between the first and second legs.
15. The fluid treatment element of claim 13 wherein the composite further includes a porous medium positioned along the outer surface of the fluid treatment medium and wherein the first and second spacers are positioned between the fluid treatment medium and the porous medium and the region substantially free of structure extends between the fluid treatment medium and the porous medium.
16. The fluid treatment element of claim 15 wherein the porous medium comprises a drainage medium.
17. The fluid treatment element of any of claims 13-16 wherein the region substantially free of structure adjoins the fluid treatment medium.
18. A method of making a fluid treatment element comprising:
corrugating a fluid treatment medium to form a plurality of axially extending pleats, each pleat having a folded end, an open end, and first and second legs extending between the folded end and the open end;
forming the plurality of pleats into a generally cylindrical fluid treatment pack having first and second ends, wherein the pleats extend axially along the fluid treatment pack;
associating a spacer arrangement with the pleats to define a region within each pleat that extends axially and is substantially free of structure;
sealing the first and second ends of the fluid treatment pack to form a first fluid flow path that extends axially along the fluid treatment pack via the regions which are substantially free of structure and a second fluid flow path that extends through the fluid treatment medium to or from the first fluid flow path.
19. The method of claim 18 wherein associating the spacer arrangement with the pleats includes positioning the spacer arrangement proximate a surface of the fluid treatment medium and wherein corrugating the fluid treatment comprises corrugating the fluid treatment medium and the spacer arrangement.

20. The method of claim 18 wherein associating the spacer arrangement with the pleats comprises positioning the spacer arrangement within the pleats after corrugating the fluid treatment medium.
21. The method of any of claims 18-20 wherein associating the spacer arrangement with the pleats includes arranging the spacer arrangement to be positioned between the first and second legs of each pleat with the region substantially free of structure extending between the first and second legs.
22. The method of claim 18 wherein associating the spacer arrangement with the pleats includes forming a composite including the fluid treatment medium, a porous medium, and the spacer arrangement positioned between the fluid treatment medium and the porous medium and wherein corrugating the fluid treatment medium includes corrugating the composite and defining the region substantially free of structure between the fluid treatment medium and the porous medium.
23. The method of claim 22 wherein forming a composite including a porous medium includes forming a composite including a drainage medium.
24. A method of making a fluid a fluid treatment element comprising:
corrugating a composite to form a plurality of pleats, wherein the composite includes a fluid treatment medium having first and second opposite side edges and first and second opposite surfaces, a drainage medium positioned along the first surface of the fluid treatment medium, a spacer arrangement positioned along the second surface of the fluid treatment medium proximate the first edge, and a material positioned along the second surface of the fluid treatment medium adjacent to the spacer arrangement;
forming the corrugated composite into a generally cylindrical fluid treatment pack having first and second ends, wherein the pleats extend axially along the fluid treatment pack;
stripping the material from the corrugated composite to form a region within each pleat that is substantially free of structure; and
sealing the first and second ends of the fluid treatment pack to form a first fluid flow path that extends axially along the fluid treatment pack via the regions which are substantially

free of structure and a second fluid flow path that extends through the fluid treatment medium from or to the first fluid flow path.

25. A process for treating a cellular solution comprising:

passing the cellular solution axially along a pleated fluid treatment element within the pleats, including directing the cellular solution axially along a region within each pleat that is substantially free of structure, and

passing one or more substances through a fluid treatment medium of the fluid treatment element from or to the cellular solution in the region substantially free of structure.

26. The process for treating the cellular solution of claim 25 wherein directing the cellular solution axially through a region substantially free of structure includes directing the cellular solution through a region substantially without structure between first and second legs of the pleats.

27. The process for treating the cellular solution of claim 25 wherein directing the cellular solution axially through a region substantially free of structure includes directing the cellular solution through a region substantially free of structure between a fluid treatment medium and a porous medium within each pleat.